REMARKS

Reconsideration of the application, as amended, is respectfully requested. (Applicant has amended some of the claims to correct misspellings and other informalities.)

On page 2 of the office action, the Examiner rejected claims 1 through 4 and 8 under 35 U.S.C. §103 as being unpatentable over Caron *et al.* (U.S. Patent No. 5,992,215A).

The Examiner stated that Caron discloses a surface acoustic sensor apparatus that teaches all of the structural limitations of applicant's claims. He noted that, while Caron does not specifically teach an array configuration, array configurations are well known in the art. He further stated that the mere duplication of parts, without any new or unexpected results, is within the ambit of one of ordinary skill in the art, rendering applicant's invention obvious.

The Examiner's analysis does not recognize Caron's inherent limitations. Caron describes a SAW sensor system specifically designed only to measure mercury gas concentrations. Nothing in Caron suggests its use in an array configuration, nor would there be any reason to make such an arrangement since each of Caron's resonators would simply be a duplicate of each other, with a duplicate function. As claimed, applicant's novel arrangement of sensor devices in an array is <u>not</u> obvious.

Further, the Examiner's analysis does not give full meaning to applicant's claims, which applicant contends are not made obvious by Caron or knowledge of those skilled in the art. Claim 1 clearly indicates that the array is designed to provide multiple resonators to each of which a <u>different</u> (applicant is amending claim 1 to add this word) sensor coating (or no sensor coating) can be applied. Because the particular sensor coatings selected differentially absorb to one or more biological and/or chemical agents, the data collected

can provide accurate information regarding the presence or absence of one or more such agents. The array configuration is essential to the purpose of the invention.

As shown in Figs. 1 and 2 of the present application, in the case of bulk acoustic waves, the array configuration comprises resonators, each in a double sided well designed to uncouple each resonator from the adjacent resonator. The uncoupling of the resonators makes it possible to make arrays of independent resonators which can be coated with different coatings targeting different specific chemicals or biological targets. For example a resonator array of twelve uncoupled resonators (Fig. 2), each resonator having a different coating (twelve different coatings), is designed so that each resonator is uncoupled to the rest. Normally, in a piezoelectric array this coupling causes one resonator signal to interfere with the one next to it. The double inverted mesa can be used to eliminate this coupling.

In SAW devices, in an array configuration, this same coupling can cause one resonator to interfere with other resonators in the array. Figs. 5 and 6 of the present application show an array of SAW devices designed with the regions between the resonators to be thinner. This uncouples the SAW devices so that an array can be made from one substrate.

In both BAW and SAW arrays, the different sensor coatings for each resonator are selected so that orthogonal physical properties of the target agent can be measured.

Finally, the serpentine heater disclosed in Caron is not integrated to the piezoelectric substrate; instead, it "is preferably on a heater substrate having a suitable thickness, preferably wherein the piezoelectric substrate and the heater substrate each has a thickness of about 0.1 mm to about 1 mm." (Col. 3, ll. 28-31). Caron's heater is designed

to precisely maintain the temperature of the sensor, as shown in the graph of Fig. 5 (Col. 5, ll, 63-65). It is not used to facilitate thermal-gravimetric analysis.

In any event, the use of a heater in Caron, one which heats the whole substrate, would not make it obvious to build an array of resonators, some of which will each have an integrated, separately-controlled heater. Caron contains no motivation to do so, nor does knowledge of those skilled in the art.

In the present application (See Table 1), each heater and its control circuit are used to ramp temperature over a specific time period so as to force adsorbed materials out of equilibrium. The resulting mass change with temperature can be used to separate out multiple materials in one measurement as seen in the following two graphs.

In Figure 1, below, the temperature vs. time graph shows a stable temperature region just prior to the controlled thermal ramp which starts at 1 second when the temperature is raised though the use of the heater and control circuit, which ramps the temperature from 25C to 90C over 10 seconds.

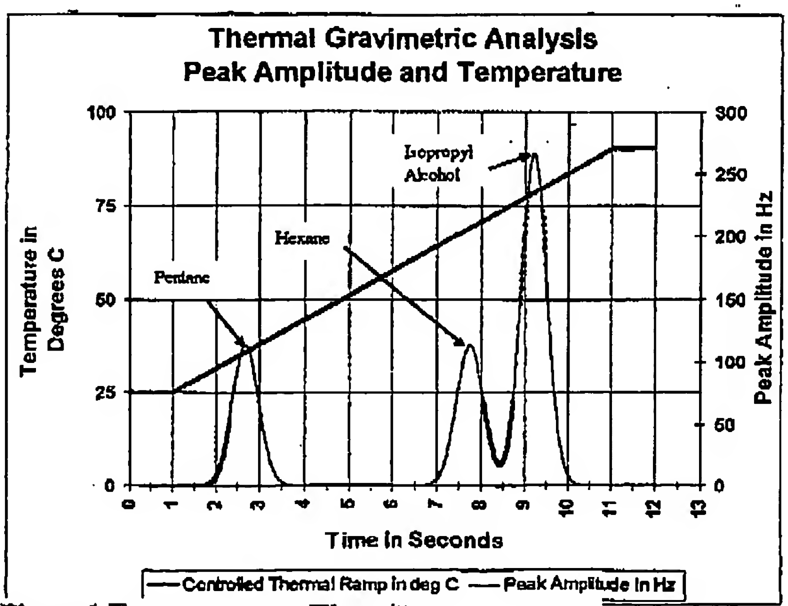

Figure 1 Temperature vs Time

Figure 2 , below, is a frequency vs. time graph showing how the frequency increases as the materials are desorbed from the sensor coating material. The sensor coating material may be a polymer designed to adsorb a wide range of chemicals where the thermal-gravimetric construction is used to separate out one material from another through the thermal ramp. This improves the standard gravimetric method normally used in piezoelectric sensors from a one dimensional measurement of mass to a two dimensional separation method using mass and temperature.

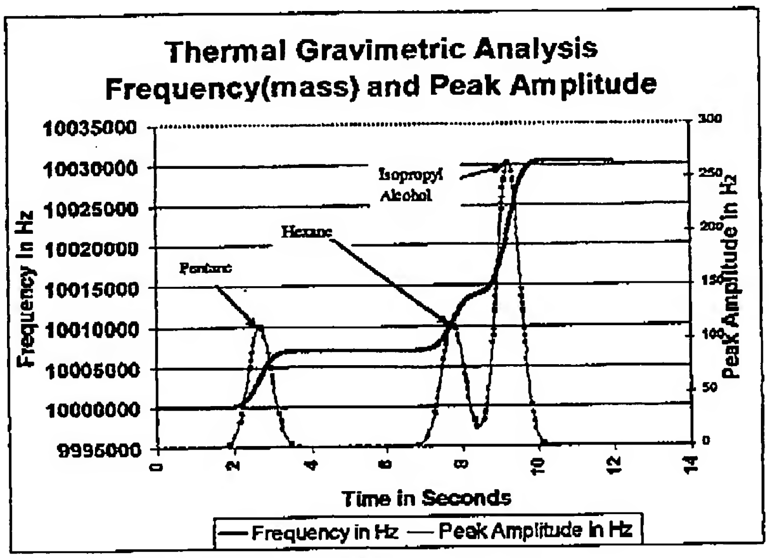

Figure 2 Frequency vs Time

In any event, applicant has amended claim 1 to more clearly claim the subject matter of his invention. In light of the arguments and amendments, claim 1 should be allowable over Caron *et al.* Claims 2-4 and 8, which depend on claim 1, should be allowable as well.

On page 4 of the office action, the Examiner rejected claim 9 under 35 U.S.C. §103(a) as being unpatentable over Caron, *et al.* in view of Neuberger (U.S. Patent No. 5,065,140). In light of the arguments, *supra*, and the amendments made, claim 1 should

now be allowable, and claim 9, which depends therefrom should also now be allowable.

On page 4 of the office action, the Examiner rejected claims 1 through 3 and 6 under 35 U.S.C. §103(a) as being unpatentable over Furuki *et al.* (U.S. Patent No. 5, 411,709A) in view of Bloch *et al.* (U.S. Patent No. 4,748,367).

The Examiner stated that Furuki teaches piezoelectric quartz resonators having a sensor coating (an organic dye) with a control and measurement circuit and means of analyzing the data collected. He states that Furuki teaches an array configuration having a plurality of gas detecting elements comprising quartz resonators. However, the quartz resonators of Furuki do not comprise the resonators with different sensor coatings claimed in the present application. In fact, Furuki explicitly states that the elements 1, 1' and 1" are simply "a plurality of gas detecting elements" (Col. 15, l. 53). Furuki later suggests that differences can be made in "the excitation light source, light receiving device, oscillator circuit, and frequency reader" (Col. 16, ll. 4-5) [with respect to each gas detecting thin film].

Since each of Furuki's resonators is simply a duplicate of each other, applicant's claimed novel arrangement of sensor devices is <u>not</u> obvious. As noted *supra*, Claim 1 clearly indicates that the array is designed to provide multiple resonators to each of which a <u>different</u> (applicant is amending claim 1 to add this word) sensor coating (or no sensor coating) can be applied. Because the particular sensor coatings selected differentially absorb to one or more biological and/or chemical agents, the data collected can provide accurate information regarding the presence or absence of one or more such agents. The particular array configuration is essential to the purpose of the invention.

As shown in Figs. 1 and 2 of the present application, in the case of bulk accoustic waves, the array configuration comprises resonators, each in a double sided well designed

to uncouple each resonator from the adjacent resonator. The uncoupling of the resonators makes it possible to make arrays of independent resonators which can be coated with different coatings targeting different specific chemicals or biological targets. For example a resonator array of twelve uncoupled resonators (Fig. 2), each resonator having a different coating (twelve different coatings), is designed so that each resonator is uncoupled to the rest. Normally, in a piezoelectric array this coupling causes one resonator signal to interfere with the one next to it. The double inverted mesa can be used to eliminate this coupling.

In SAW devices, in an array configuration, this same coupling can cause one resonator to interfere with other resonators in the array. Figs. 5 and 6 of the present application show an array of SAW devices designed with the regions between the resonators to be thinner. This uncouples the SAW devices so that an array can be made from one substrate.

In both BAW and SAW arrays, the different sensor coatings for each resonator are selected so that orthogonal physical properties of the target agent can be measured.

The Examiner noted that Furuki does not specifically teach the incorporation of one or more heater elements, wherein each heater element is integrated with one of the piezoelectric resonators. He notes instead that Furuki discloses the desirability of fixing "a flow rate of the gas to be detected, or use a reference piezoelectric vibrating element for correcting a temperature drift." (Col. 12, ll. 42-44). Furuki does not teach using a heater for <u>any</u> purpose. Nevertheless, the Examiner stated that Bloch *et al.* teaches the use of an integrated contact heater element for a piezoelectric quartz crystal resonator in order to stabilize its temperature. He stated that is would be obvious to incorporate the use of

Bloch's heater element with Furuki's detection apparatus for providing temperature stabilization.

In making the rejection, the Examiner cited MPEP 2144.07. However, the use of Bloch's heater element with Furuki involves more than a simple "selection of a known *material* based on its suitability for its intended purpose" (ital my own). The rejections cited in that section involve the selection of solvents and plastics.

In addition, applicant would point out that the heater element is Bloch is shown with a BAW resonator. The Furuki invention incorporates a SAW resonator. Furuki does not suggest combining its gas detection apparatus with a heater, and Bloch does not suggest combining its heater element for a BAW device with a gas detector. Since neither patent suggests the combination, obviousness cannot be established by combining the teachings of the two patents. *ACS Hospital Sys, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir,. 1984).

In any event, the amended claim 1 (and dependent claims 2, 3 and 6) are not obvious in light of Furuki in view of Bloch. Claims 1 through 3 and 6 should be allowable.

On page 9 of the office action, the Examiner rejected claim 9 under 35 U.S.C. §103(a) as being unpatentable over Furuki, *et al.* and Bloch *et al.* in view of Neuberger (U.S. Patent No. 5,065,140). In light of the arguments, *supra*, and the amendments made, claim 1 should now be allowable, and claim 9, which depends therefrom should also now be allowable.

In light of the foregoing arguments, and upon entry of the amendments, allowance of claims 1 through 9 should be in order and is respectfully requested.

The Examiner has indicated that claims 10 through 18 are allowed.

Applicant has added new claim 19, which depends on claim 1; applicant respectfully requests its allowance as well.

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Respectfully submitted,

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